

The Forecasting and Detection of Explosive Volcanic Eruptions by Remote Sensing, and Protection of En-Route Aircraft

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Routine observation and monitoring of volcanic eruptions utilizing remote sensing instrumentation on-board aircraft and spacecraft has become a relatively straight-forward proposition over the last 5-10 years. The *detection* of volcanic eruptions by remote sensing is substantially more difficult, however, particularly at high latitudes, given the current orbital and instrumental configurations of relevant earth observing satellites. Of particular interest in this regard, is the desire of the commercial airline industry to receive warning of hazardous stratospheric volcanic ash clouds within 30 minutes after the actual eruption, in order to avoid very real damage potentials to aircraft from ash ingestion into turbine engines and severe exterior abrasion damage. This requirement is particularly difficult because of the decreased viewing angles of the earth from geostationary orbit at latitudes above 55 degrees. Satellites in low polar orbit provide excellent monitoring capability, but leave time gaps of several to many hours depending on the latitude of interest.

Primary signatures of volcanic eruptions in the context of detection by remote sensing, observations are (1) intense eruption cloud thermal differentials of hundreds of Kelvins for short periods of time, (2) the possible presence of high concentrations of sulfur dioxide, and (3) the presence of spectrally distinct particulate (ash) and aerosol eruption clouds at stratospheric altitudes within a few minutes after the onset of the eruption. Experience has shown that all three aspects of the initial stages of volcanic eruptions can be well-characterized by remote sensing observations at uv and thermal infrared wavelengths, at appropriate spatial resolutions. Instrumental and mission approaches to problems involved in this type of observation will be discussed. (Work presented here was carried out under contract to NASA at the Jet Propulsion Laboratory, California Institute of Technology.)

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